Recommended Investigation Work Plan
Mallard North Landfill
Prepared by RMT, Inc. February 27, 2009

This work plan presents activities recommended by RMT, Inc. (RMT) to investigate the potential for landfill gas (LFG) migration at Mallard North Landfill. The Mallard North Landfill is composed of primarily inert waste and is not likely to be creating LFG in volumes or pressures which would migrate off the property. The activities described below will result in a more complete understanding of the potential for LFG migration and the need for remedial action, if any.

A number of conditions need to be met in order for LFG to migrate away from the landfill, including:

1. The waste material must degrade and LFG must be present in the landfill.
2. There must be enough LFG pressure to force the LFG out of the landfill.
3. There must be a migration pathway away from the landfill.

This work plan describes activities that will be performed to determine if any or all of these conditions exist. Select background information has been reviewed and evaluated by RMT in the course of work plan preparation. A brief summary of site conditions, based on this review, is presented in Attachment A.

The project goals will be accomplished through the following tasks to be performed by the FPD team for the Mallard North Landfill:

1. Prepare a detailed gas probe and monitoring well inventory to identify well and probe information inside and outside the waste. Gather information including actual depths, check soundness, note recommendations for monitoring port modifications, and create a summary of field information with the respective boring log and well construction report. This will be very important to provide clear and pertinent updated monitoring information.
2. Retro-fit gas probes and wells for an air tight seal with a PVC cap, valve, monitoring port, and a clear label.
3. Re-develop monitoring wells G-112R and G-119 and after re-development obtain water level measurement at a point in time removed from when leachate extraction has occurred at EW-L2. This objective of this task is to assess the possible LFG migration pathway in the vicinity of these two wells. Installation of additional shallow monitoring wells was considered but is not being proposed at this time because of permitting issues. To drill wells within a riparian area a permit application must be submitted through the DuPage County Department of Economic Planning and Development. The permitting process

usually takes two years, so this is not a task that can be completed within a short-time frame.

4. Monitor and record water levels at gas probes and wells inventoried inside and outside the waste. Create a potentiometric surface or water table map to show the current direction of groundwater flow. Compare groundwater elevations to gas probe screen elevations to identify areas where water levels may have blinded gas probes screens. Based on this comparison determine if new probes are needed.
5. Prepare a hydrogeologic cross section running through the landfill and another cross section along the southern and eastern perimeter of the landfill. The latter cross section will illustrate the relationship between the groundwater and the river and can be used to further assess the potential for off-site LFG migration.
6. Monitor gas pressure and methane content at functional perimeter gas probes and internal gas vents. Compare gas pressures inside and outside the waste to determine if a pressure gradient exists.
7. An assessment will be made to determine if new gas probes are necessary to clearly identify and alert the FPD of potential LFG migration. Tentatively, two new gas probes may be needed on the west side of the site in the area of the town homes and an additional two new gas probes may be needed along the northern border of the site.
8. Check the storm sewer at the west side of the site for LFG levels.
9. An updated gas probe and water level monitoring table will be prepared to aid in data gathering. Gas monitoring is to include pressure, methane, oxygen, carbon dioxide, and water levels. An ongoing monitoring plan for LFG and leachate will be established. This plan may consist of weekly monitoring for 6 months, monthly monitoring for 6 months, and then quarterly monitoring until trends are established.
10. The FPD has been, and will continue to be, proactive in addressing concerns over LFG. Monitors have already been installed in the nearby schools and the FPD has offered to place monitors in nearby homes and town homes. A number of owners/tenants have accepted these offers and have monitors installed, but others have not accepted the offer. If the results of the investigation activities indicate that additional monitors should be installed, the FPD will attempt to install monitors to the extent that owners/tenants will allow installation.

After completion of these tasks, the FPD will prepare a technical memorandum that summarizes the results of the investigation, presents conclusions with regard to landfill gas migration and recommends appropriate follow-up activities (i.e., additional investigation or remedial action, as appropriate). The FPD will continue to monitor and document LFG and groundwater information to assess trends and to anticipate and address environmental concerns.

Attachment A
Summary of Pertinent Site Characteristics

Hydrogeology

Groundwater levels were measured in select monitoring wells during November 2008. Prior to that date, the most recent data available to RMT were collected by EMCON in May 1999. Based on these two data sets, groundwater is present at depths ranging from less than 5 feet below ground surface (bgs) to more than 20 feet bgs. EMCON created a potentiometric map based on the data collected on May 19, 1999. The groundwater flow direction was generally to the south and southeast away from a groundwater high located in the northwest corner of the landfill. Given the topography of the site and vicinity, it is likely that groundwater enters the landfill through the northern landfill wall, moves through the landfill and leaves along the southeast, south and southwestern perimeter.

Based on a review of available information, it appears that the water table is generally present at shallow depths and within fill material, alluvium or the Wadsworth till. Monitoring wells and/or liquid probes are screened at various elevations and potentiometric data are available at three depth zones at multiple locations. These data suggest that the unconsolidated deposits are saturated from the water table downward (e.g., perched conditions do not appear to exist). In addition, these data suggest a downward vertical groundwater gradient in the Wadsworth till. Groundwater appears to leave the property along the eastern, southern and southwestern perimeters of the landfill, which are bounded by the river. Groundwater elevations, based on November 2008 data from the shallowest groundwater monitoring wells (G-series) located along this perimeter, range from 757.38 to 768.69 ft M.S.L.

The relationship between groundwater and the river is important in understanding the potential for landfill gas migration and/or groundwater contaminant migration to the east, south and southwest of the landfill. If the river and the shallow groundwater system are hydraulically connected, landfill gas can not migrate beyond the river. If an unsaturated zone exists below the river, then there is the potential that landfill gas could migrate under and beyond the river where this unsaturated zone exists if there is both sufficient LFG volume and pressure present in the landfill. These are the subject of further investigation also contemplated by the investigation presented in the work plan.

Although river water elevations were not obtained concurrently with the groundwater elevations, it appears based on review of the topographic map that the river water elevation is approximately 765 feet M.S.L. Based on the February 23, 2009 site visit, it appears the river may be several feet deep, such that the base of the river bed might be approximately elevation 762

feet M.S.L. EMCON (EMCON, 1999) estimated that the base of the engineered river channel was at approximate elevation 762.5 feet M.S.L.

A comparison of groundwater elevations at the shallowest wells located on the north and west side of the river with the estimated river base elevation suggests that the river and shallow groundwater system are hydraulically connected along approximately 80% of the river reach abutting the eastern and southern portions of the landfill. In other words, there is no unsaturated zone beneath the river in this reach. However, there is an apparent exception to this: November 2008 groundwater elevations at wells G-112R and G-119 were 751.32 and 757.38 feet M.S.L., respectively. These two groundwater elevations are lower than any other groundwater elevations north and west of the river, and it is possible that these data are not representative of the water table. Assuming, for the sake of argument, that these groundwater elevations are representative of the water table (and they may not be) there would be approximately 5 to 11 feet of unsaturated material below the river in this limited area. However, these groundwater elevations may not be representative of the water table. Well G-112R is screened at approximately 37 to 52 feet bgs and the groundwater elevation represents the potentiometric head at this depth. As indicated earlier head decreases with depth in the Wadsworth till and deeper monitoring wells will have lower potentiometric head not representative of the water table. Also, these wells have not been used for some time and the well screens may be clogged.

Potential for Landfill Gas Migration

A number of conditions need to be met in order for landfill gas (LFG) to migrate away from the landfill, including:

- The waste material must degrade and LFG must be present in the landfill.
- There must be enough LFG pressure to force the LFG out of the landfill.
- There must be a migration pathway away from the landfill.

The following discussion focuses on the possible migration pathways. Each of the conditions listed above will be more fully evaluated when the work plan is implemented.

In the reaches where the groundwater and river are hydraulically connected the landfill gas can not migrate beyond the groundwater/river interface. However, chemical constituents present in the landfill gas could dissolve in the groundwater and be transported in the dissolved phase within the groundwater system. Given the close proximity of the groundwater monitoring wells to both the landfill and the river, groundwater quality data from these wells would likely be a reasonable predictor of the potential for off-site migration of chemical constituents in groundwater.

EMCON collected groundwater samples from select groundwater monitoring wells in February 1999. Monitoring wells G-109, G-112R, G-114S and G-122, all located between the landfill and

the river were sampled and samples were analyzed for select inorganic chemical constituents, metals and volatile organic compounds (VOCs). VOCs are of particular interest, because they can be present in landfill gas and can dissolve in the groundwater if landfill gas is in contact with groundwater. With one exception, VOCs were not detected in these groundwater samples at concentrations above the reporting limits. The one exception was well G-122 locate on the west side of the landfill, which indicated a benzene concentration of 25.4 µg/L. This is consistent with the results of sampling performed at well EW-L2, which is located within the landfill - VOCs were not detected during sampling performed in 2008. The absence of VOCs in monitoring wells located along the southern and eastern perimeter of the landfill (and in a well located within the landfill) indicates that off-site migration of VOCs is not a concern in these areas.

Assuming for the sake of argument that there is an unsaturated zone beneath the river in the vicinity of monitoring wells G-112R and G-119, any potential that might exist for landfill gas migration beneath the river appears to be confined to this relatively small area. In addition, other conditions would need to be met: there would need to be gas in the landfill and at sufficient pressure to force migration out of the landfill. Further evaluation is necessary to evaluate this possibility; see the Recommended Investigation Work Plan for the activities that will be performed to address this and other issues.